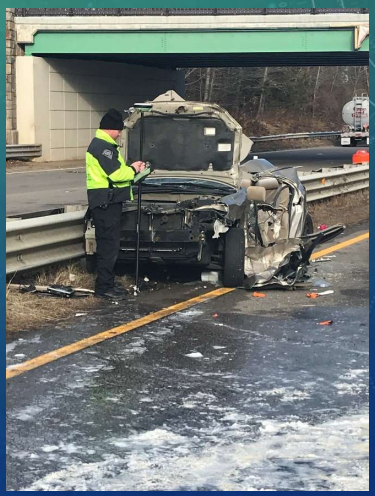
UPDATED ELECTRONIC SURVEY EQUIPMENT FOR THE STATE POLICE CRASH RECONSTRUCTION UNIT

PRESENTED BY LIEUTENANT RICHARD WOLANSKI,
C.A.R.S. UNIT COMMANDER

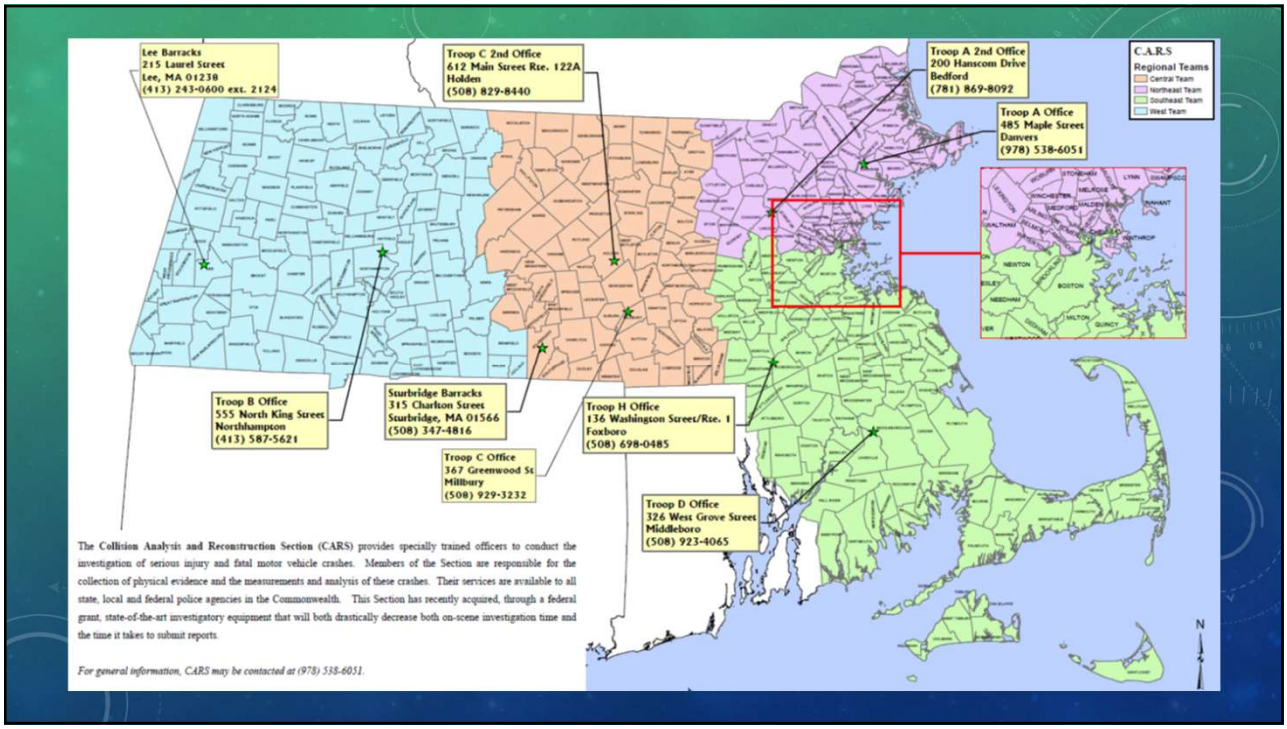
1

COLLISION ANALYSIS & RECONSTRUCTION SECTION

- Statewide Unit
- 19 Troopers, 2 Sergeants
- Divided into Four Teams:
  - Northeast (Essex, Middlesex)
  - Southeast (Norfolk, Suffolk, Bristol, Plymouth, Cape & Islands)
  - Central (Worcester)
  - West (Hampden, Franklin/Hampshire, Berkshire)



2



3

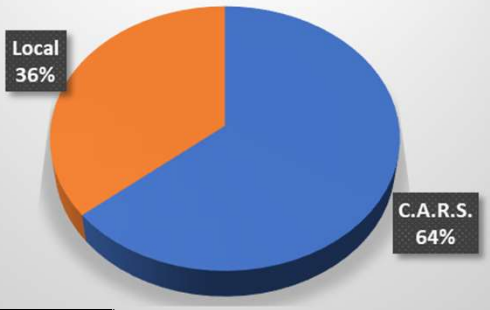
C.A.R.S – RESPONSE PROTOCOL

MSP General Order TRF-12

1. When any crash involves a fatality;
2. When any "serious injury" crash involves a strong possibility of criminal charges being filed;
3. When any Department vehicle collision involves serious injury or death;
4. When any serious injury occurs at a work zone where a member is working a paid detail;
5. When any Department pursuit results in serious injury or death;
6. Upon request by another police department/agency (#1 and/or #2 should be present)
7. Upon request of any Local, State or Federal agency, for the purpose of forensic mapping of crime scenes. (after consultation and approval of the CARS Section Commander through the Team Leader)
8. As directed by the Troop/Section Commander.

4

Fatal Crashes: 2019-2021

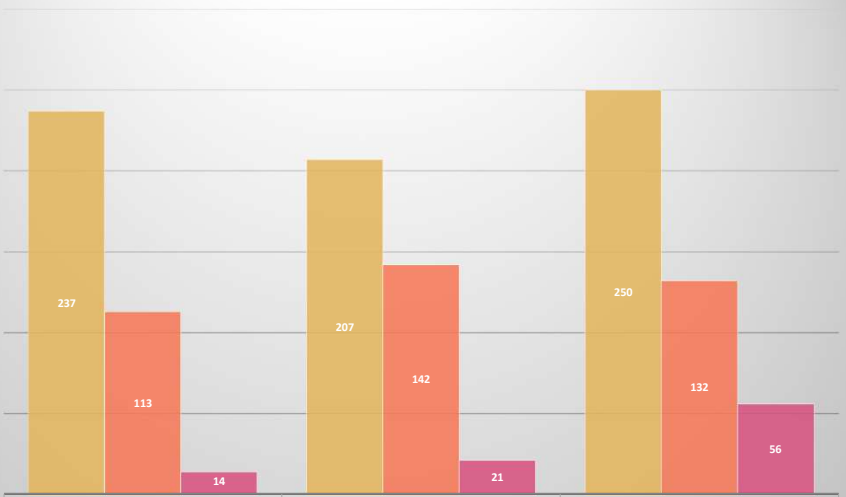


AGENCY	2019	2020	2021
C.A.R.S.	237	207	250
Local	100	133	158
Totals:	337	340	408

Data from MassDOT IMPACT web portal

5

C.A.R.S. Investigations



	2019	2020	2021
Fatal	237	207	250
Serious Injury	113	142	132
Forensic Mapping	14	21	56

TOTAL CALL-OUTS **364** **370** **438**

6

PROJECT GOALS

- Increase data collection for fatal & serious injury crashes by 50%
- Increase data accuracy by 150%
- Increase C.A.R.S. available mapping equipment by 50%
- Provide accurate, to-scale diagrams to relevant stakeholders
  - Prosecuting District Attorneys in criminal cases
  - MassDOT
  - RMV
- Reduce traffic congestion related to road closures due to crash investigations

7

PROPOSAL

- Purchase four (4) Leica GS18 GNSS Receivers, including CS20 Data Collectors
  - $24,185.00 per unit, for a total of $96,740.00
- Total cost of project: $96,740.00
- Training/familiarization for current members of the State Police Collision Analysis & Reconstruction Section

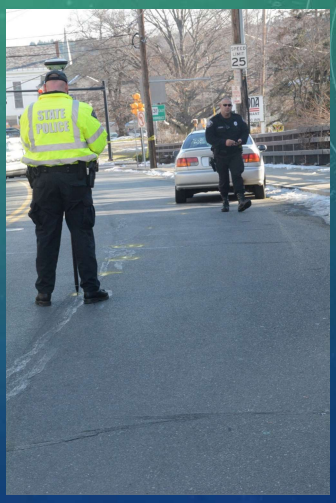
8

GNSS RTK ROVER & TOTAL STATION

9

GNSS RTK Rover

- Collects data quickly (2-3 seconds per point)
- Minimal equipment
- One-person unit
- Utilizes the Massachusetts Continuously Operating Reference Station (MaCORS) Network
- Accurate and reliable
- Records location data in 3-dimensions: longitude, latitude, and elevation



10

What is MaCORS?

From mass.gov:

MaCORS is a system of continuously operating Global Navigation Satellite System (GNSS) reference stations located throughout Massachusetts. It is designed to assist surveying, engineering, and GIS mapping professionals in a variety of static and real-time differential GNSS positioning applications. It is comprised of 20 GNSS base stations approximately 50 km apart, throughout Massachusetts.

Access to MaCORS allows Troopers to obtain location data accurate up to 3 centimeters. More traditional methods of obtaining latitude & longitude coordinates (e.g. through laptop computers, phone GPS, or vehicle navigation systems) are inaccurate and error-prone.

11

CURRENT C.A.R.S. EQUIPMENT

GNSS RTK ROVER

- Northeast Team
  - 6 Troopers
  - 2 GNSS RTK Rovers (GS14)
- Central Team
  - 4 Troopers
  - 2 GNSS RTK Rovers (GS14)
- Southeast Team
  - 7 Troopers
  - 4 GNSS RTK Rovers (GS14)
- West Team
  - 4 Troopers
  - 1 GNSS RTK Rover (GS14)

12

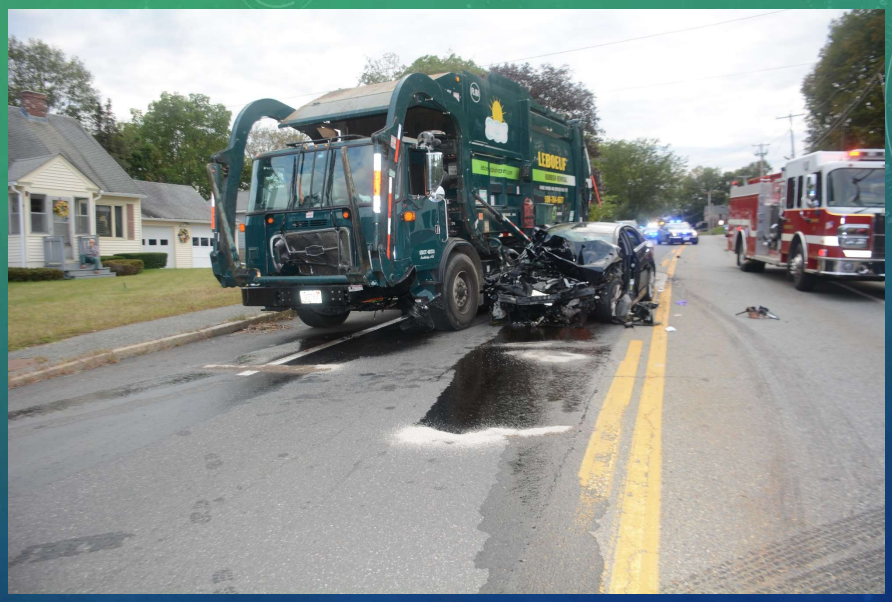
UPDATED EQUIPMENT

New to the GS18:

- Greater satellite access
  - Allows for expanded coverage in areas where cell signals are difficult to obtain
  - Allows for expanded coverage in areas where obstructions (tall structures, tree coverage) block signals
- "Tilt" feature
  - Antenna no longer needs to be level and plumb above the data point
  - This allows access to evidence previously unobtainable; for example, evidence located under a vehicle or alongside a tall structure or box trailer
- "Scan" feature
  - Captures images through integrated cameras
  - Creates "pointcloud" for 3-dimensional images

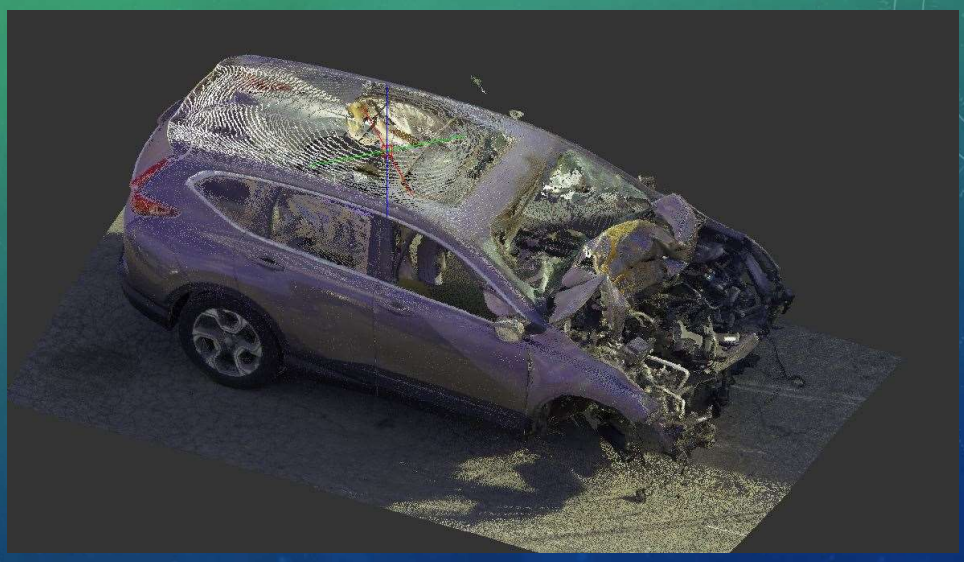
13

14



15

UPDATED CAPABILITIES



16

TOTAL STATION

- Does not require satellite acquisition
- Two-person operation
- Measures using distance and angles from a fixed point
- Records in 3-dimensions, including elevation

17

CURRENT C.A.R.S. EQUIPMENT

- NORTHEAST TEAM
  - 6 Troopers
  - 2 GNSS RTK Rovers (GS14)
  - 2 Total Stations
- Central Team
  - 4 Troopers
  - 2 GNSS RTK Rovers (GS14)
  - 1 Total Station
- Southeast Team
  - 7 Troopers
  - 3 GNSS RTK Rovers (GS14)
  - 1 Total Station
- West Team
  - 4 Troopers
  - 1 GNSS RTK Rover (GS14)
  - 0 Total Station

Currently 57% of C.A.R.S. Troopers equipped with mapping equipment

18

UPDATED EQUIPMENT

New to the TS13:

- "Robotic" capabilities
  - Equipped with Automatic Target Recognition, which tracks the prism pole and records data points
  - Allows for one-person operation
- "Prism-less" target acquisition
- Updated coding and line work features significantly reduces time in the field

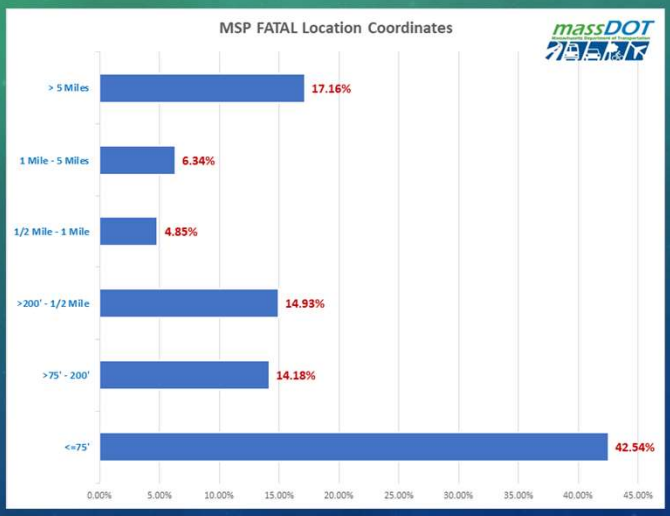
19

ISSUES TO BE ADDRESSED

- Accuracy of location data
- Expanded data capture
- Data element reporting
- Accuracy in citation & adjudication data
- Reduction in scene investigation time

20

ISSUES TO BE ADDRESSED – ACCURACY OF LOCATION DATA



Source: D. Valovcin, Law Enforcement Technical Liason, MassDOT

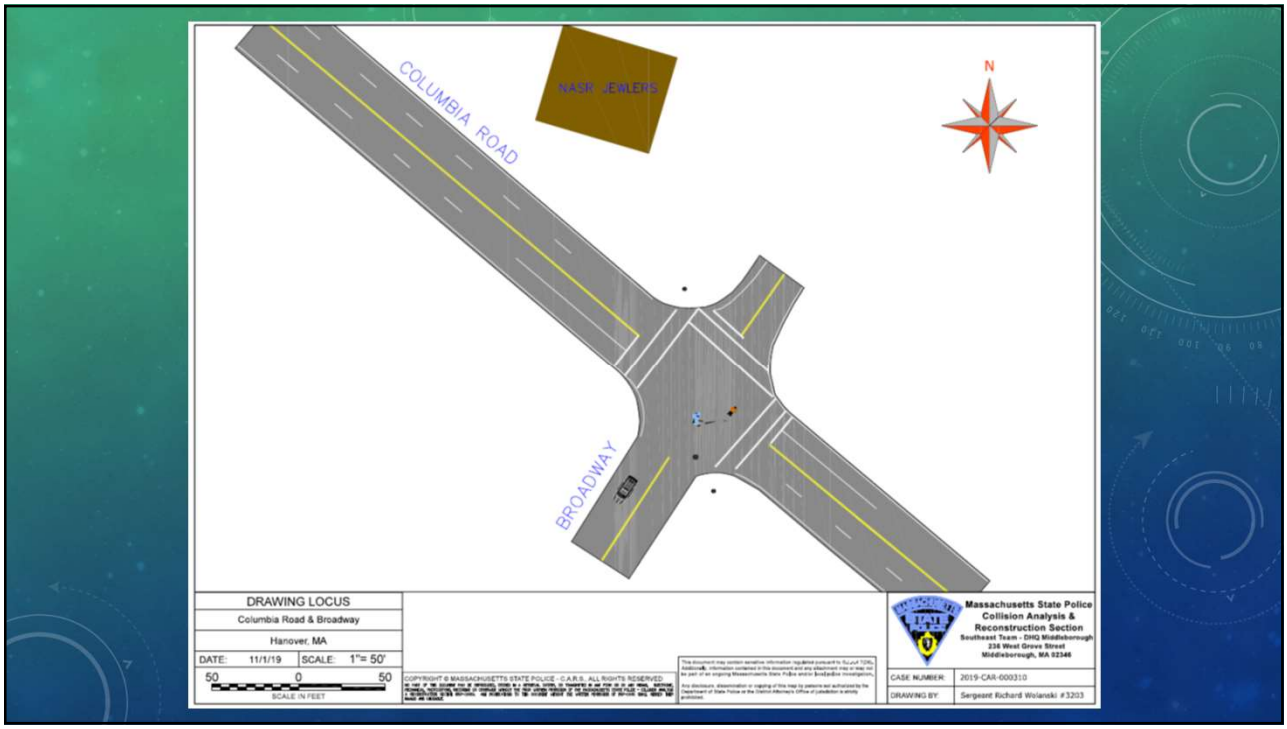
21

ISSUES TO BE ADDRESSED – ACCURACY OF LOCATION DATA

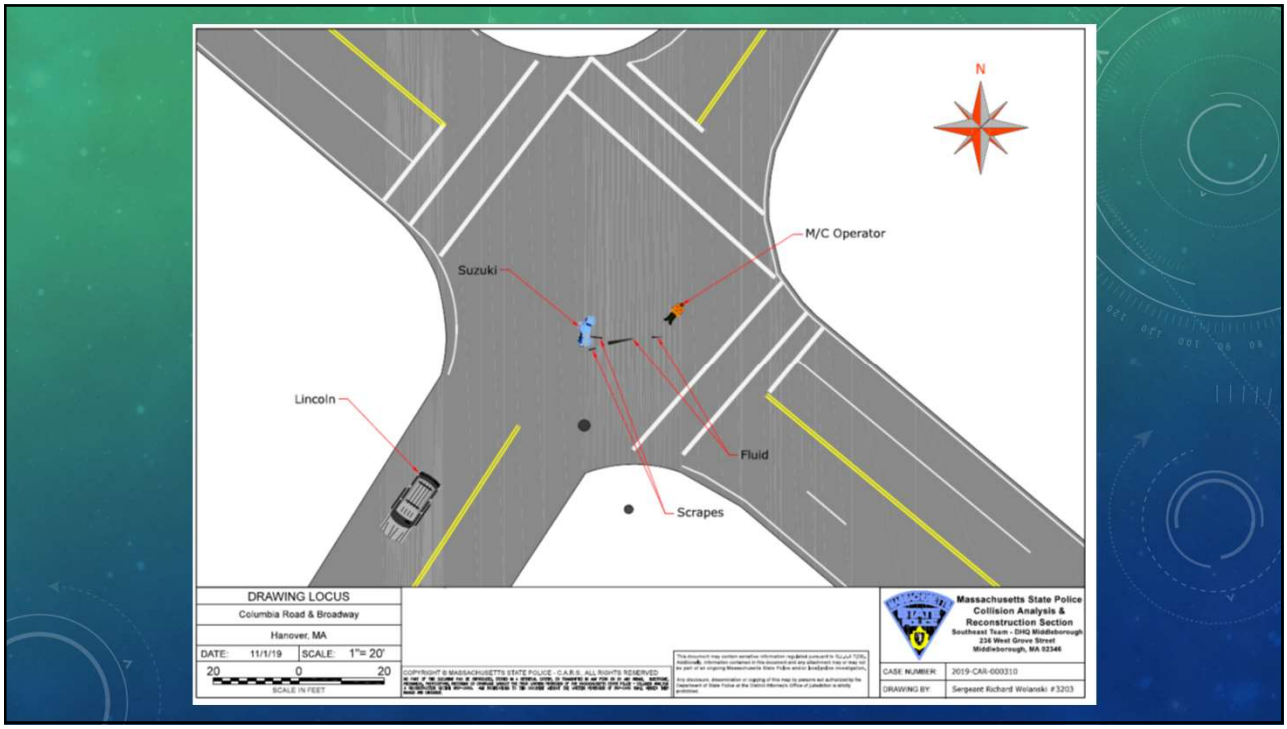
- Data sourced from 268 crashes investigated by C.A.R.S. in 2019-2020
- 57% of coordinates entered had an error in excess of 75 feet
- 43% of coordinates had an error in excess of 200 feet
- Inaccurate coordinates originated in a number of ways:
  - Phone GPS
  - On-Board Vehicle navigation Systems
  - On-line Maps (Google, Bing)
  - Unavailability of GPS equipment
    - West of the Route 495 corridor, GNSS RTK Rovers were available or operational ∽50%

SOLUTION: State Plane Coordinates Acquired through the MaCORS Network

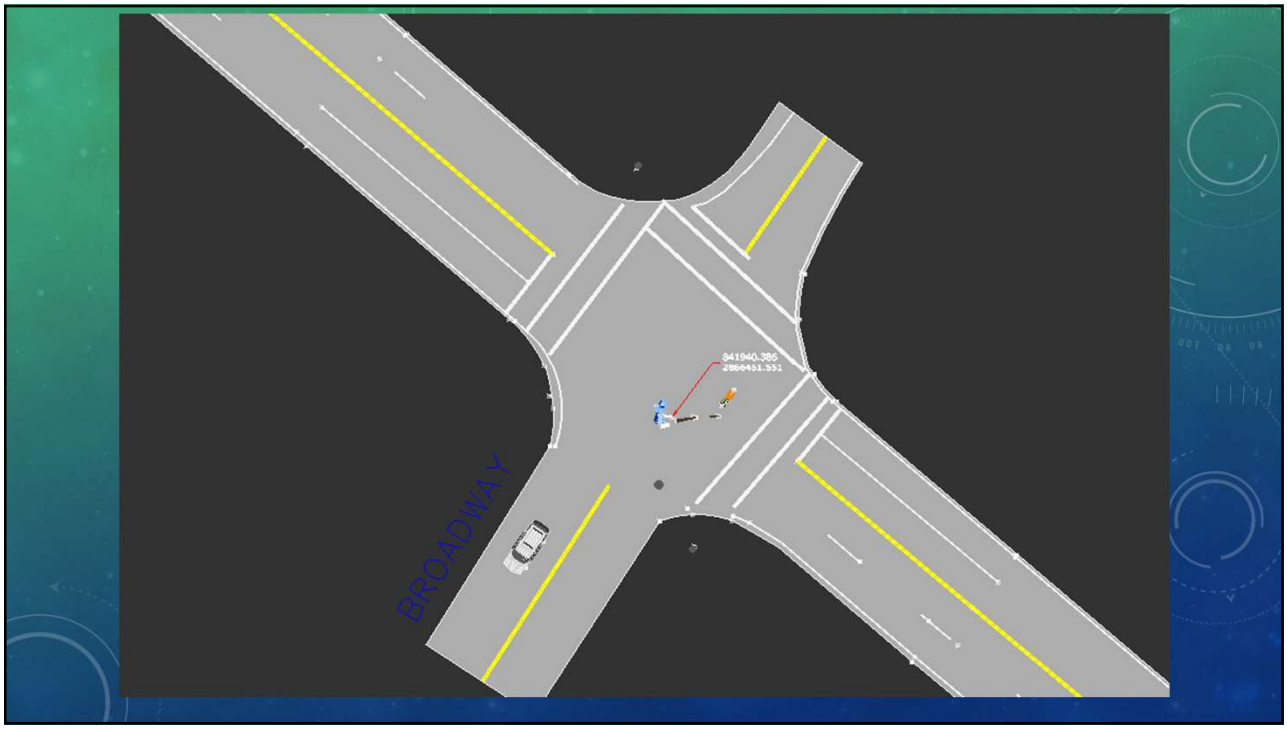
22


COLUMBIA ROAD
NASR JEWLERS
BROADWAY
N
DRAWING LOCUS
Columbia Road & Broadway
Hanover, MA
DATE: 11/1/19
SCALE: 1"= 50'
50 0 50
SCALE IN FEET
Massachusetts State Police
Collision Analysis &
Reconstruction Section
Southeast Team - DHQ Middleborough
234 West Grove Street
Middleborough, MA 02346
CASE NUMBER: 2019-CAR-000310
DRAWING BY: Sergeant Richard Wolanski #3203

23

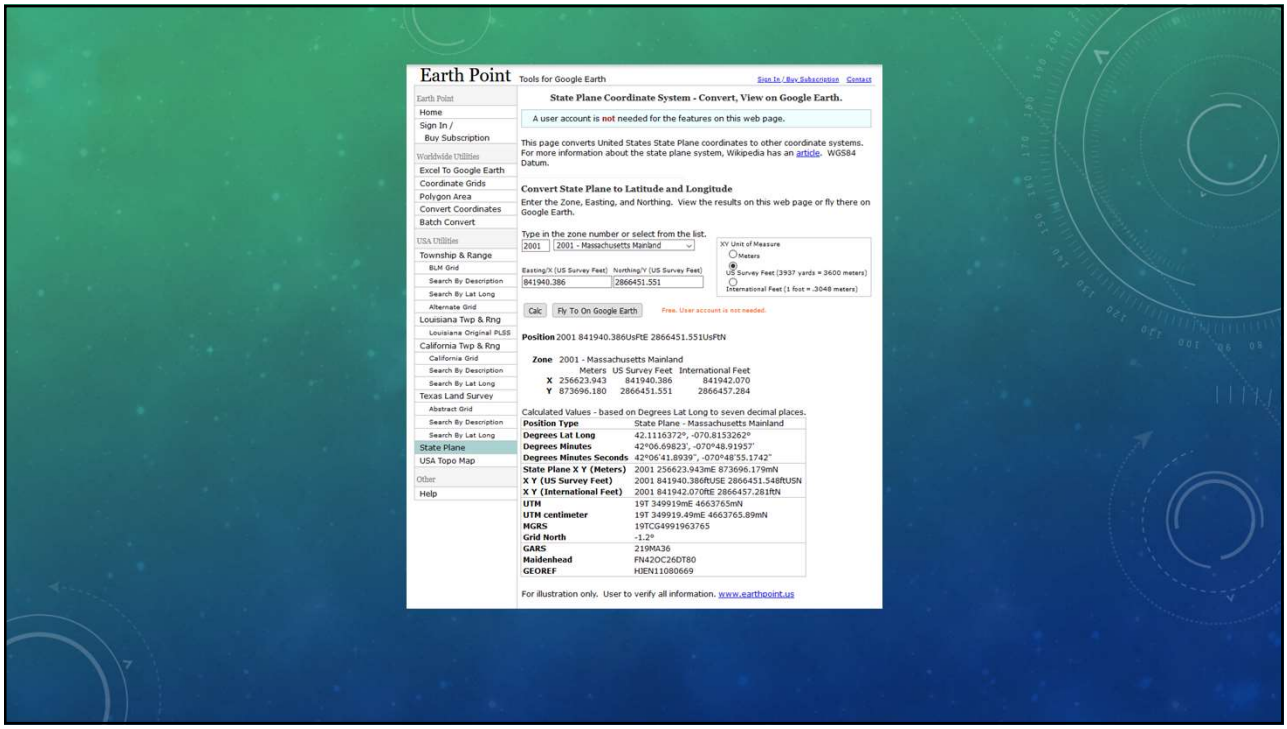

N
M/C Operator
Suzuki
Lincoln
Fluid
Scrapes
DRAWING LOCUS
Columbia Road & Broadway
Hanover, MA
DATE: 11/1/19
SCALE: 1"= 20'
20 0 20
SCALE IN FEET
Massachusetts State Police
Collision Analysis &
Reconstruction Section
Southeast Team - DHQ Middleborough
234 West Grove Street
Middleborough, MA 02346
CASE NUMBER: 2019-CAR-000310
DRAWING BY: Sergeant Richard Wolanski #3203

24

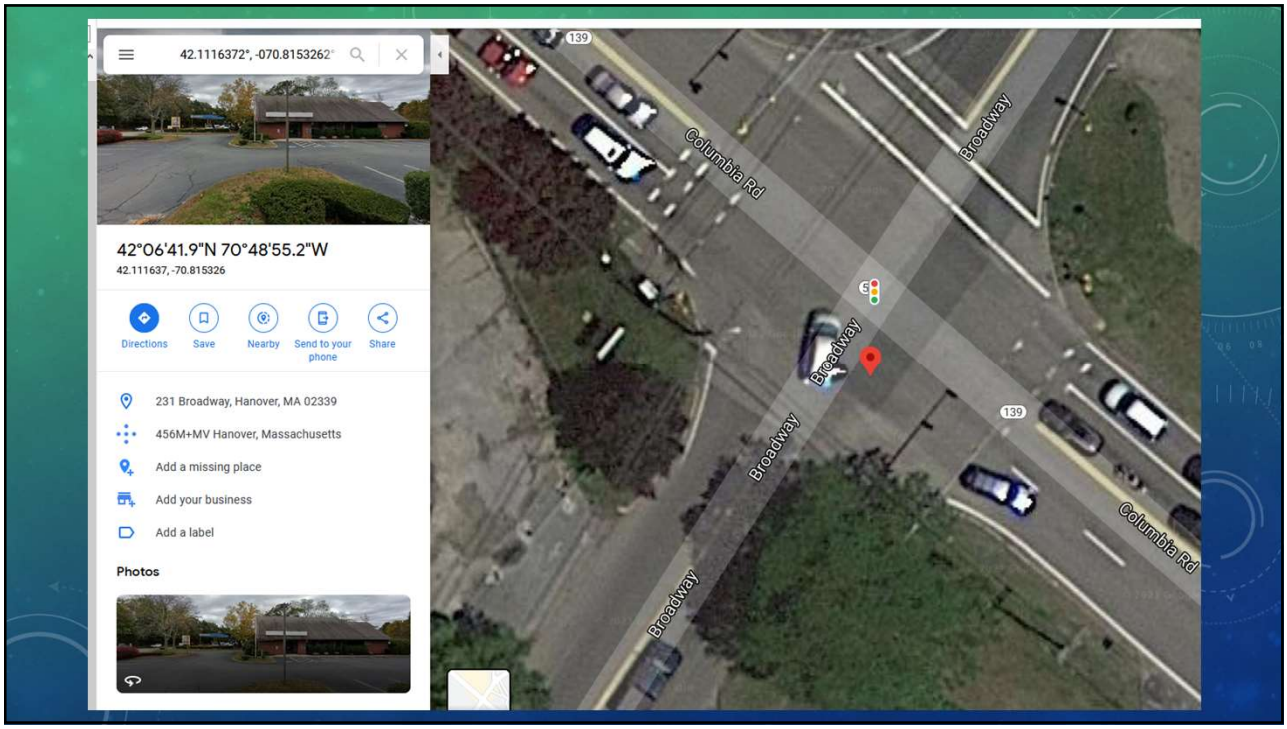


25

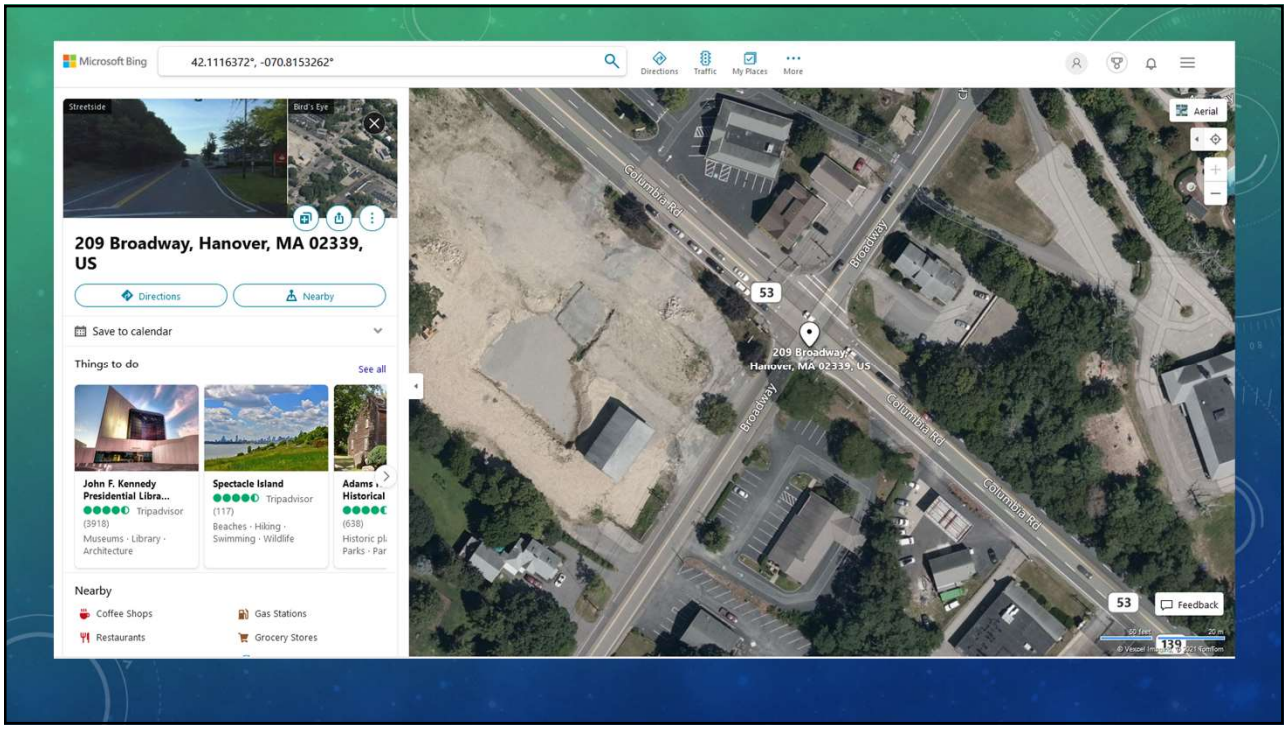
26


Earth Point
Tools for Google Earth
Sign In / Buy Subscription
Contact
State Plane Coordinate System - Convert, View on Google Earth.
A user account is not needed for the features on this web page.
This page converts United States State Plane coordinates to other coordinate systems. For more information about the state plane system, Wikipedia has an article. WGS84 Datum.
Convert State Plane to Latitude and Longitude
Enter the Zone, Easting, and Northing. View the results on this web page or fly there on Google Earth.
Type in the zone number or select from the list.
2001 - Massachusetts Mainland
Easting/X (US Survey Feet)
Northing/Y (US Survey Feet)
841940.386
2866451.551
Calc
Fly To On Google Earth
Position 2001 841940.386UsFtE 2866451.551UsFtN
Zone 2001 - Massachusetts Mainland
Meters US Survey Feet International Feet
X 256623.943 841940.386 841942.070
Y 873696.180 2866451.551 2866457.284
Calculated Values - based on Degrees Lat Long to seven decimal places.
Position Type State Plane - Massachusetts Mainland
Degrees Lat Long 42.1116372°, -070.8153262°
Degrees Minutes 42°06.69823', -070°48.91957'
Degrees Minutes Seconds 42°06'41.8939", -070°48'55.1742"
State Plane X Y (Meters) 2001 256623.943mE 873696.179mN
X Y (US Survey Feet) 2001 841940.386ftUSE 2866451.548ftUSN
X Y (International Feet) 2001 841942.070ftE 2866457.281ftN
UTM 19T 349919mE 4663765mN
UTM centimeter 19T 349919.49mE 4663765.89mN
MGRS 19TCG4991963765
Grid North -1.2°
GARS 219MA36
Maidenhead FN42OC26DT80
GEOREF HJEN11080669
For illustration only. User to verify all information. www.earthpoint.us

27


42.1116372°, -070.8153262°
42°06'41.9"N 70°48'55.2"W
42.111637, -70.815326
Directions
Save
Nearby
Send to your phone
Share
231 Broadway, Hanover, MA 02339
456M+MV Hanover, Massachusetts
Add a missing place
Add your business
Add a label
Photos
139
Columbia Rd
Broadway
Broadway
Broadway
Broadway
139
Columbia Rd

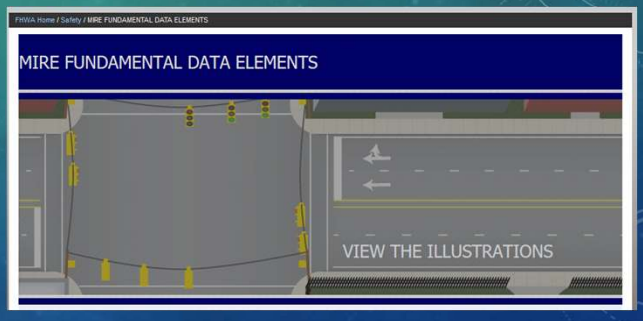
28



29

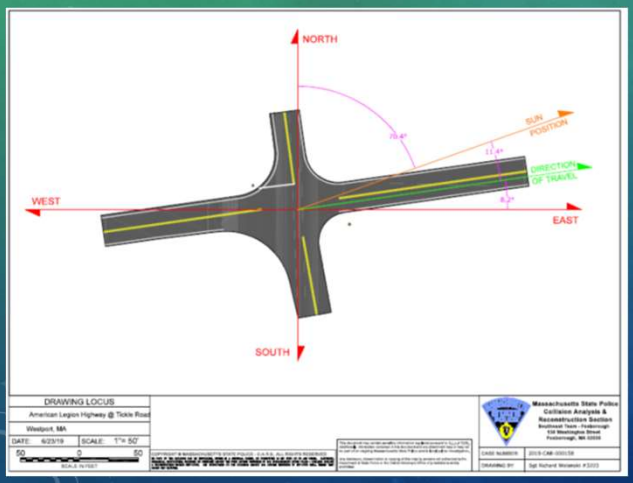
ISSUES TO BE ADDRESSED - DATA ELEMENT REPORTING

- MIRE Fundamental Data Elements
  - Paved Surface Characteristics
  - Number/Type Travel Lanes
  - Shoulder, Median, & Roadside Descriptors
  - Traffic Control Devices
  - Intersection Features



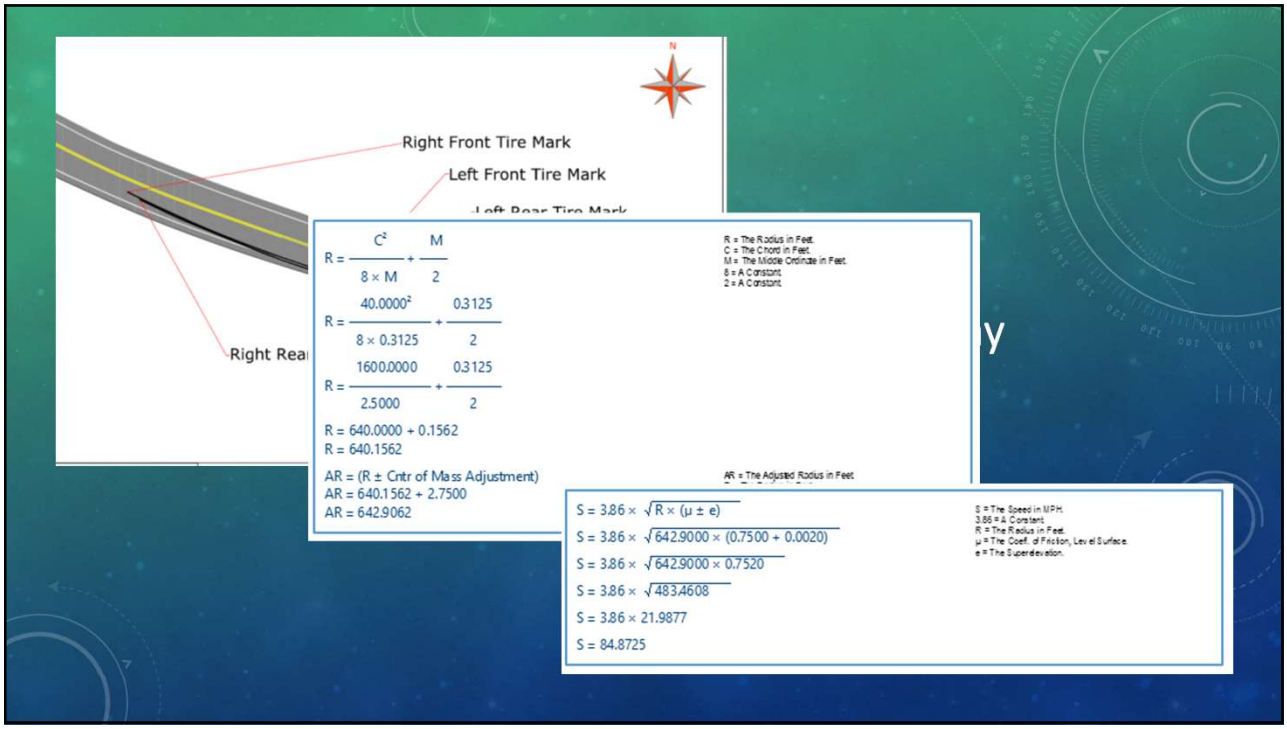
30

ISSUES TO BE ADDRESSED – ACCURACY IN CITATION & ADJUDICATION DATA

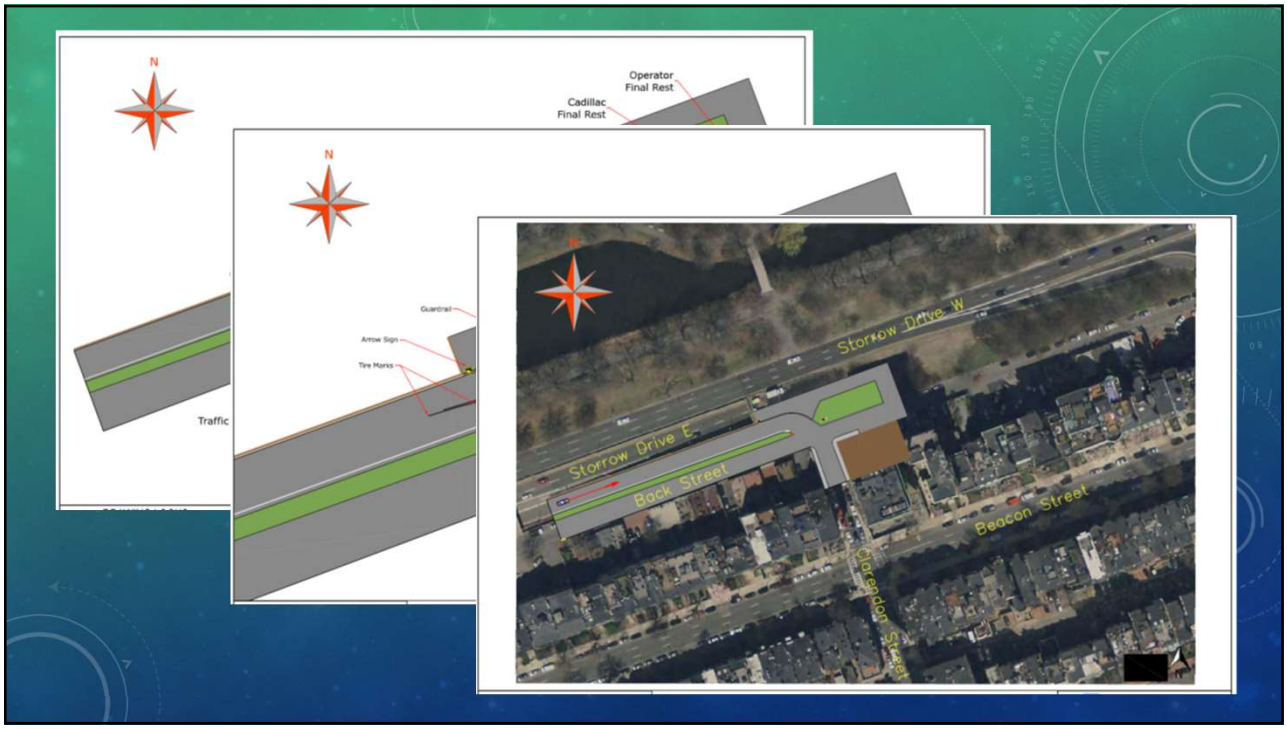


- Courtroom Testimony
- Roadway Design
- Safety Assessment

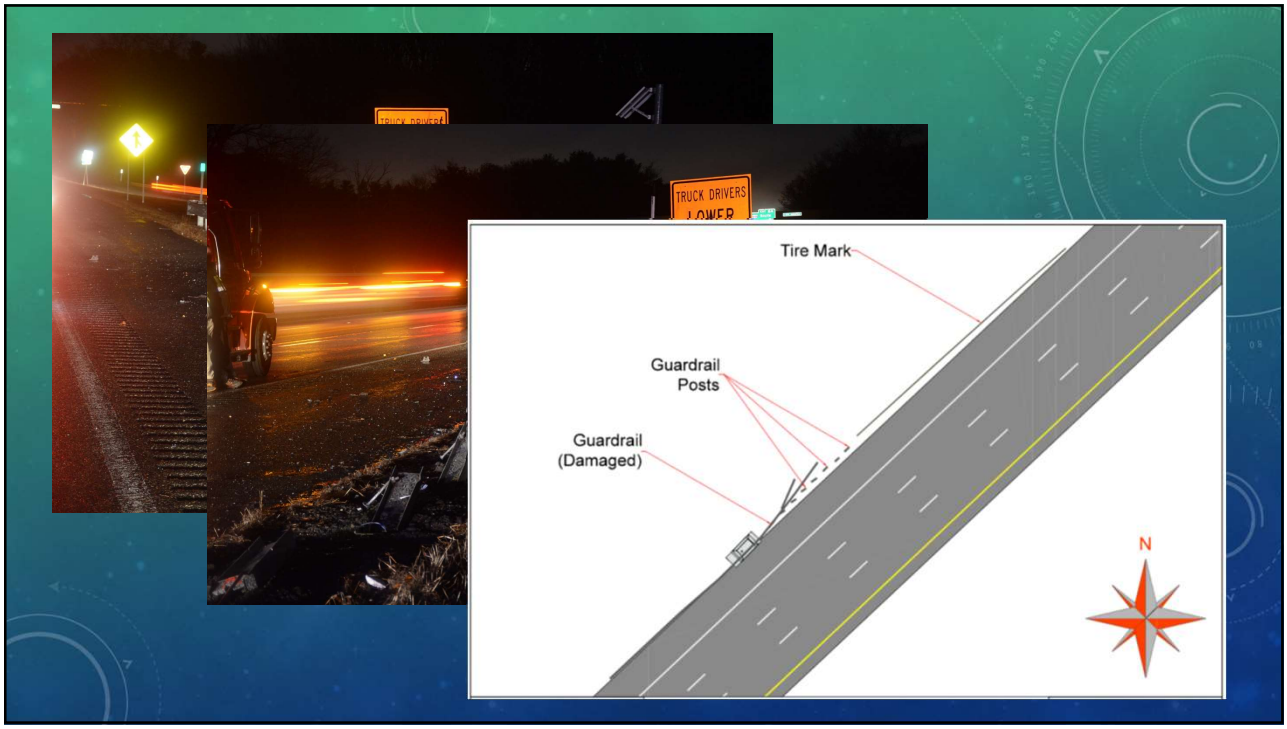
31



32


N
Operator
Final Rest
Cadillac
Final Rest
Traffic
Guardrail
Arrow Sign
Tire Marks
Storrow Drive W
Storrow Drive E
Beacon Street
Clarendon Street

33


TRUCK DRIVERS
Tire Mark
Guardrail
Posts
Guardrail
(Damaged)
N

34

ISSUES TO BE ADDRESSED – REDUCTION IN SCENE INVESTIGATION TIME

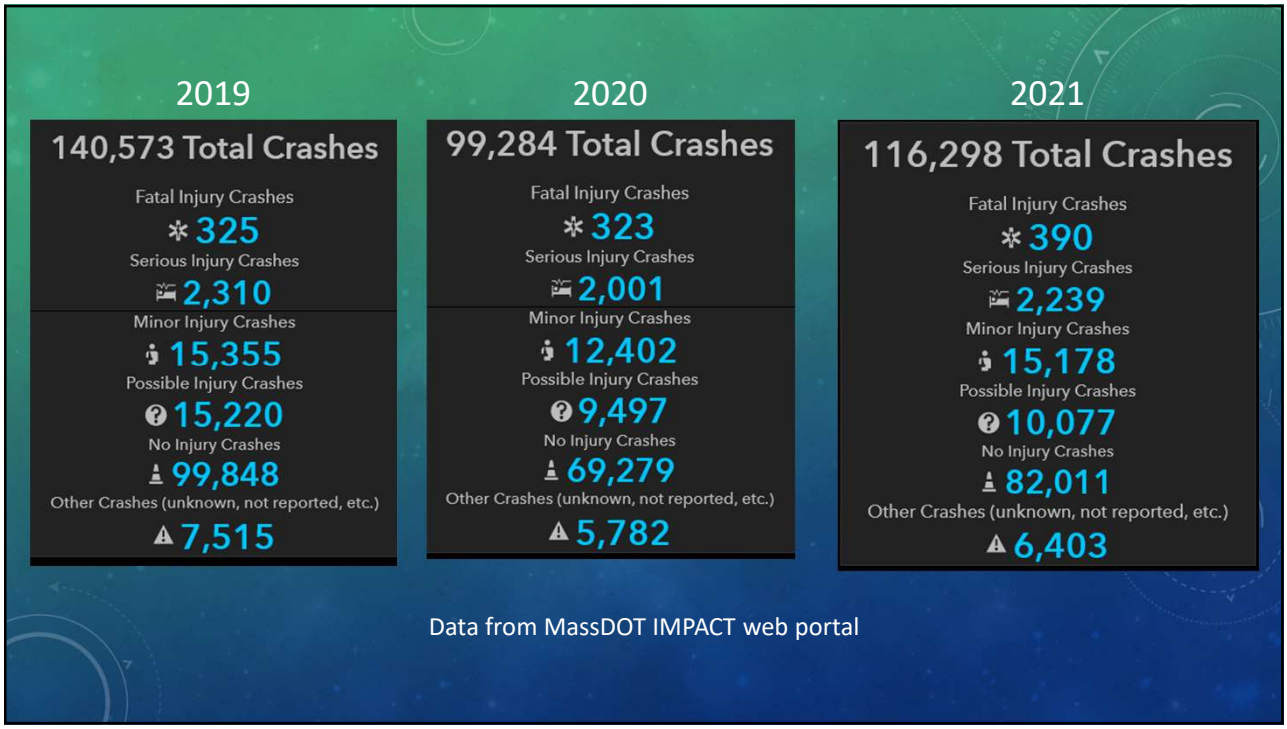
- According to a study conducted by INRIX, Boston ranked number 1 in traffic congestion in 2019
- The average cost per driver in 2019 was $2,205; the city of Boston lost an estimated $4.1 Billion
- Serious injury and fatal crashes can cause delays up to 2-3 hour, and often have "downstream" effects

2019 CONGESTION RANK (2018)	URBAN AREA	HOURS LOST IN CONGESTION	2018-2019 CHANGE	2017-2018 CHANGE	INCIDENT IMPACT	COST PER DRIVER	TOTAL COST PER CITY	BIKE	TRANSIT	LAST MILE SPEED (MPH)
1 (1)	Boston, MA	149	-5%	3%		$2,205	$4.1B			12
2 (3)	Chicago, IL	145	4%	0%		$2,146	$7.6B			11
3 (5)	Philadelphia, PA	142	4%	5%		$2,102	$4.5B			10
4 (2)	New York City, NY	140	-4%	-3%		$2,072	$11B			11
5 (3)	Washington DC	124	-11%	4%		$1,835	$4.1B			10
6 (7)	Los Angeles, CA	103	4%	-8%		$1,524	$8.2B			16
7 (6)	San Francisco, CA	97	-8%	-4%		$1,436	$3B			10
8 (9)	Portland, OR	89	10%	-7%		$1,317	$1.2B			14
9 (11)	Baltimore, MD	84	5%	9%		$1,243	$1.3B			10
10 (12)	Atlanta, GA	82	9%	-3%		$1,214	$3.0B			12

35

2020 saw a significant decrease in congestion. However, fatality rates did not decrease in Massachusetts. Fatal crash investigations remain a significant cause of traffic delays.

36



37

BENEFITS OF QUICK CLEARANCE

- SAFETY
  - Reduction in secondary crashes
  - Safety of first responders in crash scene
- FINANCIAL
  - Financial cost of delays to Commonwealth & individual motorists
  - Overtime of personnel on scene
- INVESTIGATIVE
  - Ability to collect more data points
  - Accurate data collection allows for precise analysis in the future

38

39